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Massive Tumor Thrombus in Left Renal Vein and Inferior Vena Cava in Renal Cell Carcinoma on 18-fluorodeoxyglucose Positron Emission Tomography/computerized Tomography: “Suspension Bridge Sign”

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Abstract

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Tumor thrombosis is a relatively uncommon complication of renal cell carcinoma (RCC), and its diagnosis has therapeutic and prognostic implication. Computerized tomography (CT) is the primary imaging modality for staging RCC, but it has low sensitivity to differentiate between tumor thrombus and bland or benign thrombus. 18-fluorodeoxyglucose positron emission tomography/CT (PET/CT) has a limited role in diagnosis and staging of RCC, but its diagnostic accuracy is considerably high for detection of metabolically active tumor thrombus. We are presenting a case of metastatic left-sided RCC with massive hypermetabolic tumor thrombus extending from left kidney to left renal vein and inferior vena cava giving an interesting “Suspension Bridge” appearance on PET/CT images.

Keywords: 18-fluorodeoxyglucose positron emission tomography/computerized tomography, bland thrombus, massive tumor thrombus, renal cell carcinoma

Introduction

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Renal cell carcinoma (RCC) is the most common solid tumor of the kidneys, accounting for 3% of all malignancies and representing the seventh leading cause of cancer.[1] An unusual hallmark of RCC is the biological predisposition for vascular invasion, with the extension of tumor thrombus into the renal veins and inferior vena cava (IVC) in 24% and 12% of all cases, respectively.[2] Preoperative diagnosis of tumor thrombosis and its extent is paramount as it needs surgical resection (nephrectomy and thrombectomy) to have local control and prognostic implication as about 33% patients also have concurrent metastasis.[1] RCC is also associated with hypercoagulable state and development of bland IVC thrombus which usually do not require thrombectomy. The differentiation between tumor thrombus and bland thrombus is not usually possible with contrast-enhanced computerized tomography (CECT) or magnetic resonance imaging (MRI).[3] However, 18-fluorodeoxyglucose (¹⁸FDG)-based positron emission tomography/CT (PET/CT) imaging has the capability of accurate anatomical localization of tumor spread and can differentiate between bland and tumor thrombus based on ¹⁸FDG uptake by viable tumor cells.[4]

We are presenting a case of the left RCC with extensive ^{18}F FDG tumor thrombus in the left renal vein and IVC mimicking “Suspension Bridge” on PET/CT imaging.

Case Report

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A 72-year-old male presented with a history of painful sternal swelling and fine needle aspiration biopsy was positive for metastatic cancer most like renal origin. An ^{18}F FDG PET/CT study was advised for localization of primary tumor and staging. The patient was administered 190 MBq (3 MBq/kg) of ^{18}F FDG (fasting blood glucose 90 mg/dl), and after 55 min of uptake period, imaging was performed using Celesteion, Toshiba, Japan. First a low-dose non-CECT (NCECT) scan was acquired from skull to mid-thigh (Voltage: 140 kV; Current 80 mA; CT Dose Index volume [CTDI_{volume}]: 2.80 mGy) followed by PET imaging in 3-D mode using 3 min/bed position in caudocranial direction. Images revealed intense ^{18}F FDG uptake over left kidney extending into left renal vein and IVC with retrograde and antegrade extension (T12–L2 level) mimicking a “Suspension Bridge Sign.” On NCECT images, involved left renal vein and IVC segment were dilated with an ill-defined mass lesion in interpolar region of left kidney [Figure 1]. Standardize uptake values (SUV_{max}) over left kidney, left renal vein, and IVC were 10.9, 13.4, and 16.6 (Liver SUV_{mean} 2.08). In addition, there was ^{18}F FDG avid destructive bony lesion involving the body of sternum. The patient underwent left nephrectomy, and thrombectomy and histopathology revealed RCC with massive tumor thrombus extension into the left renal vein and IVC.

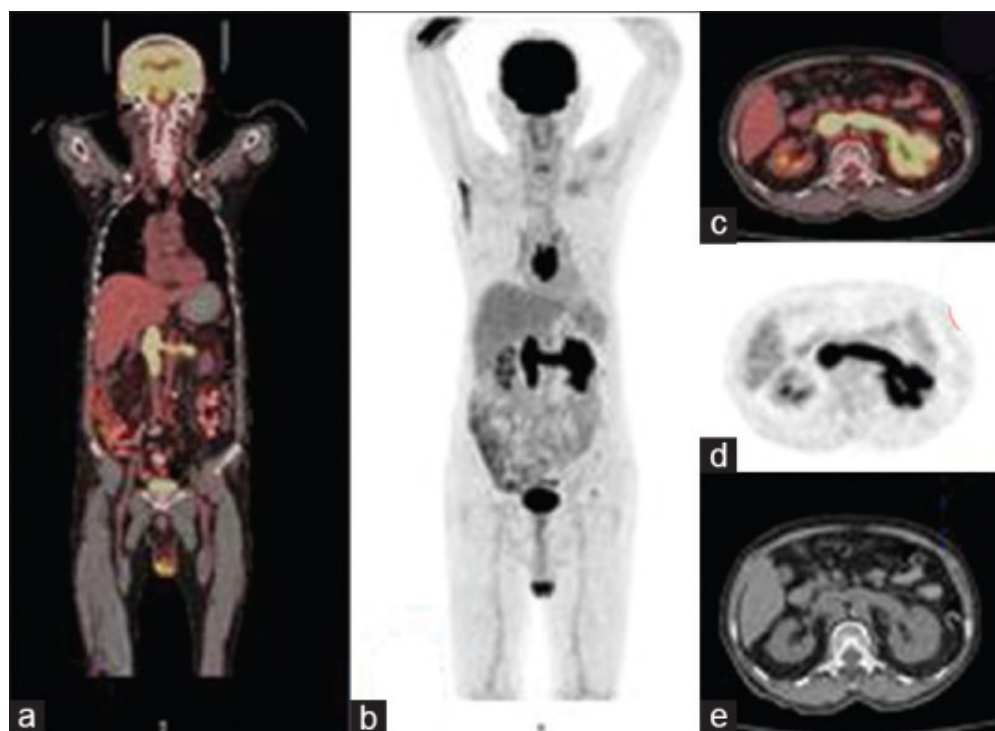


Figure 1

18-fluorodeoxyglucose positron emission tomography/computerized tomography study (low-dose noncontrast enhanced computerized tomography). (a) Fused coronal image showing hypermetabolic tumor thrombus in left renal vein and inferior vena cava; (b) maximum intensity projection image showing “Suspension Bridge Sign” appearance of hypermetabolic tumor thrombus in abdomen. Hypermetabolic focus over lower chest represents sternal metastasis; (c-e) axial images showing hypermetabolic tumor thrombus extending from left kidney to dilated inferior vena cava through dilated left renal vein

Discussion

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CECT is the imaging of choice for diagnosis and staging of RCC with a reported sensitivity of 92%.^[5] However, ¹⁸FDG PET/CT has a limited role for RCC as excreted ¹⁸FDG may obscure or mask the lesions of the kidneys. Therefore, ¹⁸FDG PET/CT is not recommended for diagnosis and staging of RCC in current guidelines.^[6] In the management of RCC, detection of tumor thrombosis, its extent, and differentiation between bland or venous thrombosis is important. Venous or bland thrombosis is commonly seen in cancer which is managed with anticoagulant therapy, while tumor thrombosis requires aggressive multimodality therapeutics. Differentiation between these two entities is important for therapeutic and prognostic point of view which may not be possible with CECT or MRI.^[3] Recent data show that ¹⁸FDG PET/CT has higher sensitivity and diagnostic accuracy for detection of tumor thrombosis and bony metastasis as compared with CT and bone scan, respectively.^[7] IVC is the most common site with a linear shaped ¹⁸FDG uptake by viable tumor thrombus. SUV_{max} of tumor thrombus in our case was significantly high (renal vein: 13.4 and IVC: 16.6) which is in concordance with published reports.^[6] In the present case, hypermetabolic tumor thrombus was very extensive, extending from left kidney passing through left renal vein and entering into IVC with antegrade (infrahepatic) and retrograde extensions giving an appearance of suspension bridge on maximum intensity projection and coronal images. To the best of our search, we could not find any report in literature with such an extensive tumor thrombus in RCC giving this type of interesting appearance.

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Conflicts of interest

There are no conflicts of interest.

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